

SUMMARY

MARKET DEVELOPMENT OF FLOATING AND BOTTOM-FIXED OFFSHORE WIND

THE LONG-TERM POTENTIAL FOR THE NORWEGIAN OFFSHORE WIND INDUSTRY



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Preface

Menon Economics analyses economic issues and provides advice to businesses, organisations, and public authorities. We are a consulting firm operating at the interface between economics, politics, and markets. Menon combines social and business economics expertise in fields such as social profitability, economic impact, business and competition economics, strategy, finance, and organisational design. We use research-based methods in our analyses and work closely with leading academic environments in most fields.

This is the English summary from the published report. The entire report in is available in Norwegian on our website www.menon.no

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Executive summary

The international power market is currently undergoing a significant transformation. If we are to succeed in limiting global warming, we must develop enormous amounts of emission-free generation capacity. Until now, onshore wind and solar have dominated the development on most continents. From 2030 onwards, offshore wind is emerging as an important supplement if we are to meet future power needs and decarbonize industry, transport and private consumption. This is because many countries have, or will face, limitations of space on land. In addition, offshore wind technology has characteristics that will complement the rest of the power supply.

Offshore wind has already established itself as a multinational industry, driven by technological innovation and cost reductions. As of today, there are a significant number of projects under development, and new records are constantly being set in terms of investment decisions, auctions and area allocations. This is true even though the market has experienced considerable turbulence in recent years as a result of increased inflation, capacity challenges in the value chain and increased financing costs. Floating offshore wind is still at a pre-commercial stage. This is reflected in a significantly higher cost level compared to more mature technologies such as solar power, onshore wind and bottom-fixed offshore wind. The development of floating offshore wind has so far been mainly limited to smaller pilot projects. In the long term, significant cost reductions are expected as the technology develops. This is also reflected in a growing portfolio of areas under development.

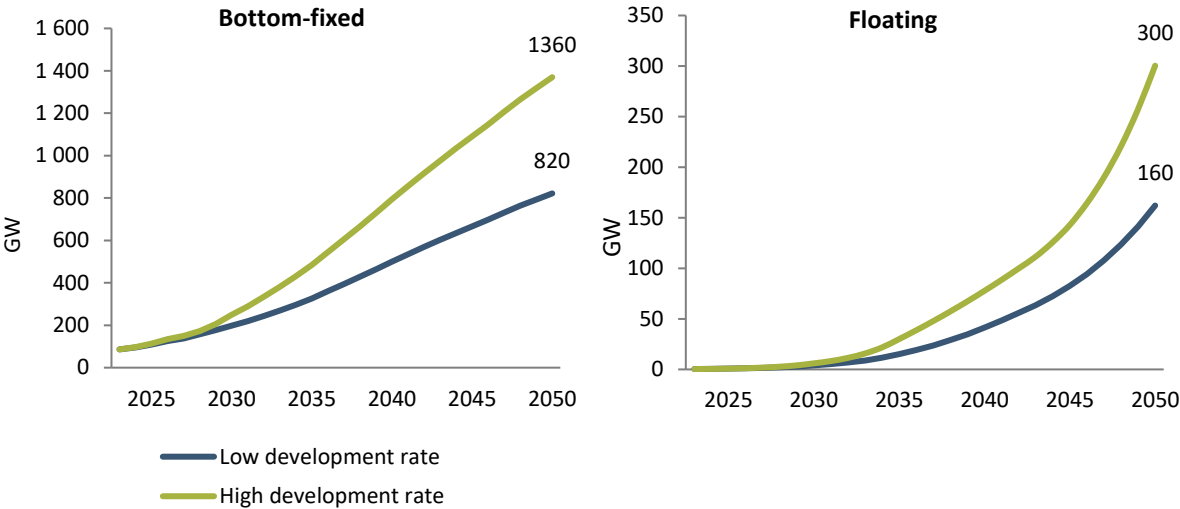
This report analyses and assesses the market development for floating and bottom-fixed offshore wind, as well as the long-term revenue potential of the Norwegian offshore wind industry. The report is an update of Menon's floating offshore wind analysis from 2022, but also includes analyses of the market for bottom-fixed offshore wind.

Long-term market outlook for bottom-fixed and floating offshore wind

To assess the market development for floating and bottom-fixed offshore wind, we use a two-step methodology. The first step involves an assessment of short-term developments. This analysis is based on offshore wind projects and areas mapped through TGS 4C Offshore. In the analysis, we have weighted the various projects in terms of maturity, as well as the underlying trend related to the announcement of new areas. This gives us two development scenarios for the next 10 years. The long-term analysis focus on how different market drivers can affect the underlying trends we have identified in the short term. Our forecast is benchmarked against a wide range of third-party analyses that weigh these drivers differently. This approach ensures robustness in the range of outcomes we have identified, both with respect to short-term political as well as market variations.

Our forecasts show that the installed capacity of bottom-fixed offshore wind will be between 820 and 1 360 GW by 2050. For floating offshore wind, we expect an installed capacity of 160 and 300 GW. The upper range for both bottom-fixed and floating offshore wind is based on a scenario where development is driven by an aggressive climate policy (demand side), limitations in land availability (demand side), and falling development costs over time (supply side). The latter is based on Menon's (2024) recently published analysis of cost developments in the offshore wind market. Such a development will strengthen the competitiveness of both technologies compared to the current competitive situation, opening up new markets for offshore wind. In the case of floating offshore wind, development depends heavily on national targets being followed up with measures to ensure technological and commercial maturity over the next 10-15 years. Thus, the market for floating offshore wind is associated with a higher political risk than the bottom-fixed market.

Figure A: Long-term market forecasts for fixed and floating offshore wind. Source: Menon Economics

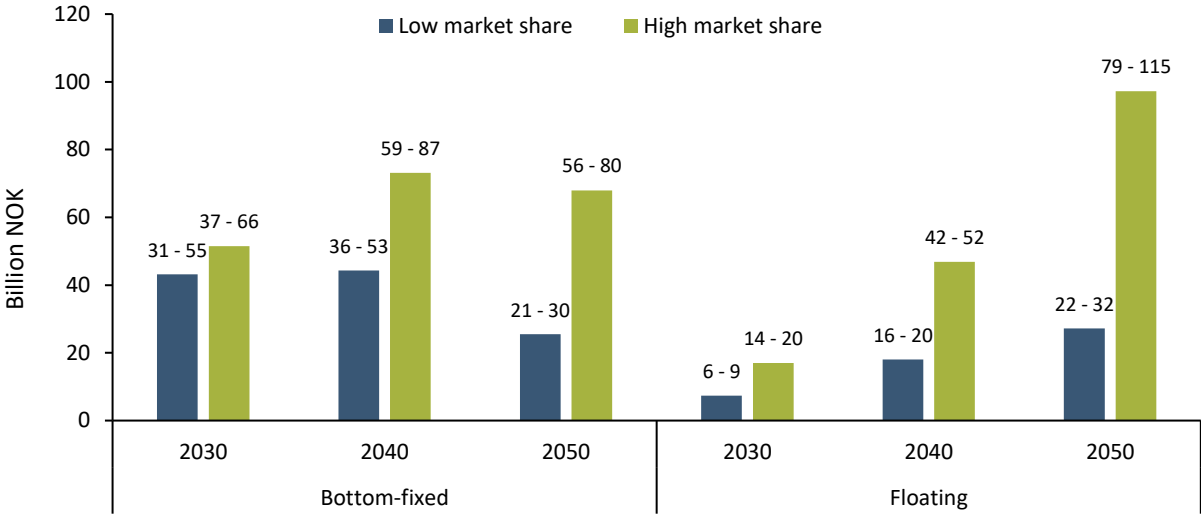


It is important to view the development of bottom-fixed and floating offshore wind in context of each other. Fixed offshore wind is currently more cost-effective to develop, which is reflected in our market forecasts. However, once the most favourable areas for bottom-fixed offshore wind have been developed, we see significant potential for investments to shift towards floating offshore wind. Our analyses indicate that such a shift will occur around the 2040s, after a period of significant technological and commercial maturing for the latter. This will result in a significant acceleration in capacity development for floating installations, while the rate of development in bottom-fixed offshore wind flattens out.

Norwegian industry’s revenue potential

Today's Norwegian offshore wind industry is dominated by established market players who have succeeded in positioning themselves in the international market for bottom-fixed offshore wind. The economic footprint of floating offshore wind is currently limited. However, many companies are targeting this market segment, with activity along the entire value chain. Based on our analyses, we expect the Norwegian offshore wind industry to achieve an annual revenue between 22 and 115 billion NOK in 2050. The uncertainty in our estimates are related to both uncertainty in market development and, in particular, future competitiveness. The upper range of NOK 79 to 115 billion assumes the successful development of a leading value chain for floating offshore wind in Norway, based on the transfer of offshore and maritime expertise. In order to succeed in this, it is necessary to take a dominant role along the entire value chain. Particularly important is fabrication and assembly, which currently accounts for around 25 percent of the investment cost in floating offshore wind. The Norwegian industry currently play a key role in the development of technology related to the floater itself. If we succeed in scaling today's concepts to operational infrastructure, we will facilitate significant export-based "production", as well as the export of technology to markets that are too far away from Norwegian fabrication and assembly ports. Fabrication and assembly in Norway will also increase opportunities for deliveries from the rest of the value chain, as most components are installed in ports before the turbines are towed out for connection and anchoring. The lower interval of NOK 22 to 32 billion implies a situation where we have not succeeded in developing a complete value chain in Norway. We also assume a very limited development in the domestic market. This limits the development of infrastructure and technology, which contributes to Norwegian revenue being dominated by the market position of a smaller number of companies. Such a development could result in export-based revenue on a par with today's bottom-fixed market.

Figure B: Estimated annual revenue for Norwegian players in *bottom-fixed* and *floating* offshore wind. Source: Menon Economics



Even though many Norwegian players are currently established in the international bottom-fixed market, little attention has been paid to business development in this segment. Our analyses point to a significant potential for bottom-fixed offshore wind also in the long term. We estimate that Norwegian players in this segment could achieve annual revenue of between NOK 21 billion and NOK 80 billion in 2050, with the upper range of NOK 56 billion to NOK 80 billion corresponding to maintaining the current market share in the global market. It is important to point out that maintaining the current market share in this context implies a significant strengthening of Norway's market share in the European market, while at the same time ensuring a certain presence in Asia and America. Europe has historically been very dominant in the offshore wind market. However, we do not expect this situation to persist on the long term. Maintaining the current market is therefore considered an ambitious but achievable upper interval in our analysis. The lower interval of NOK 21 to 30 billion implies that Norwegian players maintain their position in Europe. However, the global market share falls significantly as the development shifts towards other geographical markets. The largest annual revenue is likely to come around the 2040s, when the pace of development for bottom-fixed offshore wind is at its highest.

Key success factors

The revenue potential of Norwegian players in offshore wind depends on how big the market becomes, as well as the competitiveness of the Norwegian industry. As highlighted above, competitiveness will have a greater impact on the revenue potential than the size of the market. To ensure that the significant potential that exists in the above-mentioned forecasts can be realized, Norway's current competitive advantages must be built upon. We consider the following factors to be particularly relevant:

- An active domestic market will strengthen Norwegian players in both markets, but the impact will be greater in the current commercialization phase of floating offshore wind.
- Strengthened international commitment from the Norwegian offshore wind industry, with the established players at the forefront.
- Accelerated technology development, focusing on standardization, robotization and automation.
- Ensuring sufficient production capacity around the technology concepts that are established, especially within port services as well as assembly and installation.
- Transfer of resources and capitalization on existing expertise, supported by the willingness of the Norwegian industry to adapt.

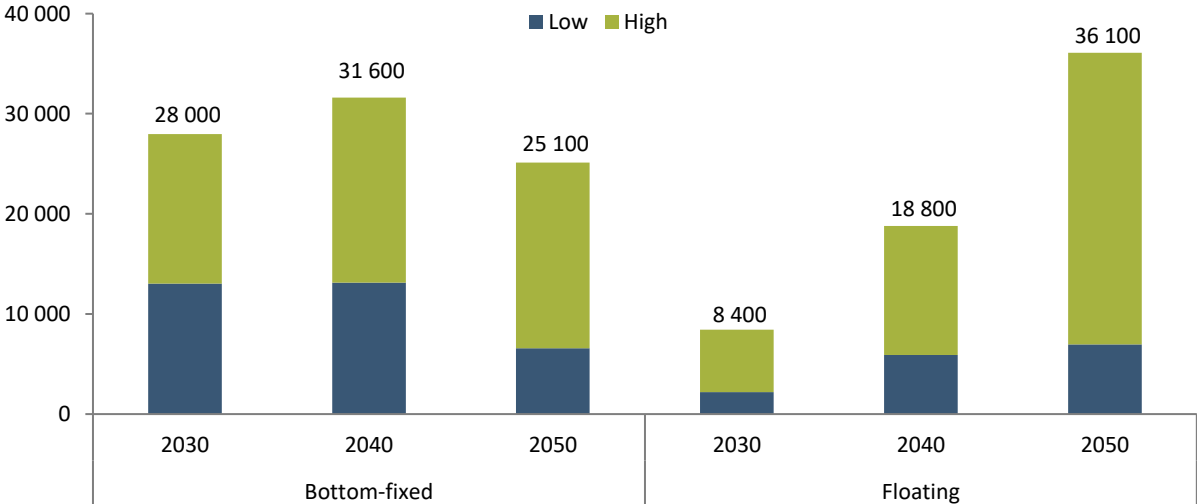
The economic impact of a Norwegian-based floating and fixed offshore wind industry

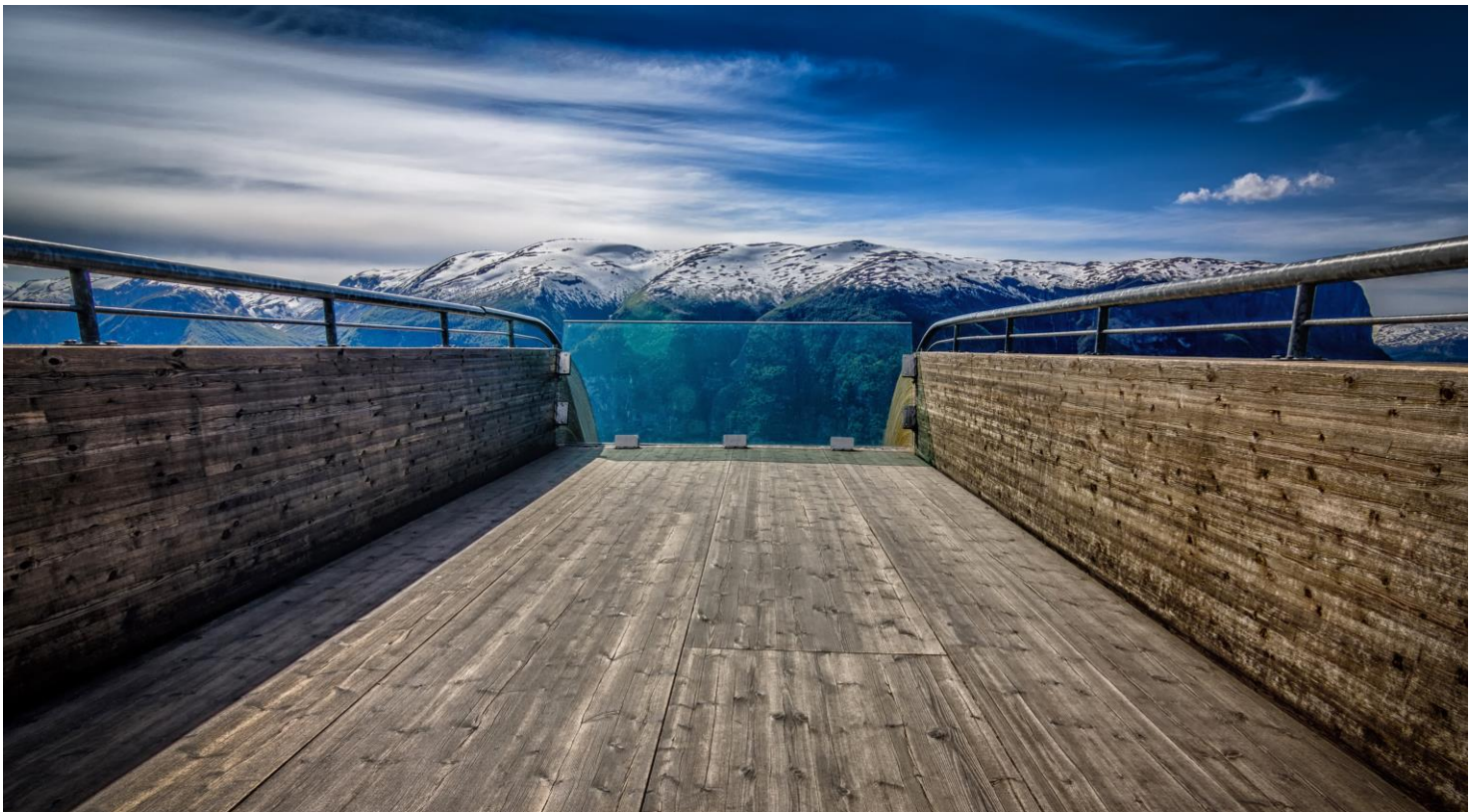
A successful establishment of an offshore wind industry will generate significant economic impact in Norway. Based on Menon's economic impact model, we find that a Norwegian-based industry linked to floating offshore wind could support between 7 000 and 36 000 jobs in 2050, depending on market development and the competitiveness of the Norwegian industry. The industry could also provide GDP contributions of between NOK 15 billion and NOK 78 billion in 2050. Calculations of the economic impact of the bottom-fixed industry show employment effects of between 6 600 and 25 100 employees and GDP-contribution effects of between NOK 14 billion and NOK 54 billion in 2050. It is important to point out that the estimates presented here are gross figures. The net effect will depend on the alternative use of the resources, including labour and capital.

Employment and contributions to GDP will benefit all regions in Norway. However, our analyses indicate that the greatest effects will be generated in Rogaland and Vestland counties. In terms of the value chain, we have identified the largest effects in the maritime industry, which is central to the development of port infrastructure and deliveries related to specialized vessels. In addition to this, we also see significant deliveries from specialized (sub-)suppliers that currently operate in the offshore industry, as well as industrial activities.

Looking at the two markets together, our high scenario suggests that the offshore wind market could support over 36 000 employed in 2030, 50 000 employed in 2040 and 60 000 employed in 2050. If we only consider suppliers that are directly linked to development and operation (direct effects), this corresponds to 15 000, 25 000 and 30 000 employees respectively. According to Statistics Norway, around 30 000 people are currently employed in specialized offshore deliveries. In other words, if the high scenario is realized, it is necessary to restructure and/or develop a highly skilled workforce equivalent to today's entire offshore supply industry. On the one hand, this shows that the offshore wind industry can be an important part of the transition from an economy dominated by oil and gas development. At the same time, it is important to point out that this workforce will also be very valuable in other applications. In other words, the economic impact study points to a potential barrier. Access to expertise and labour will be challenging, and a degree of cannibalization between the two market segments, as well as other new industrial establishments, will therefore be difficult to avoid.

Figure C: Economic impact (total number of employees) associated with a Norwegian-based offshore wind industry. Source: Menon Economics





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